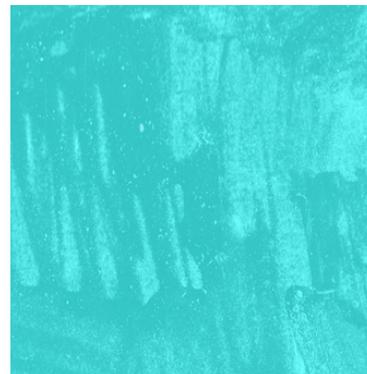




PICTURE A SCIENTIST



DISCUSSION GUIDE

INTRODUCTION

Picture a Scientist started from exploring reports in the late 1990s that exposed significant gender inequity across the sciences. As we dug into the data and spoke with dozens of scientists, we realized the vast extent of the challenges facing women and minority scientists. Despite groundbreaking efforts by the courageous scientists featured in the film and elsewhere, systemic gender bias and racism persist.

Our goal in making the film was to raise visibility around these critical issues of diversity, equity, and inclusion in science and invite viewers into a deeper conversation about how to make science more inclusive. Thus, the film is just the start.

While everyone has a role to play in changing the culture of science, this discussion guide is largely aimed toward scientists, to advance more conversations about equity in science in institutions, corporations, societies, and other groups worldwide. We invite those who have watched the film to use the resources provided herein, to keep asking questions, to encourage more discussion, and to take actions within your own communities. We look forward to seeing – and being a part of – this change.



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MEET THE SCIENTISTS

We couldn't have done this without the brilliant scientists featured in (and behind the scenes of) this film. We are immensely grateful to them for their candor and the generosity with which they shared their

experiences. We are heartened by their activism and bravery in their fight against gender inequities, racism, and sexual harassment. Read their bios to learn more and see links to their lab websites.

Nancy Hopkins is a molecular biologist and professor of biology emerita at the Massachusetts Institute of Technology. She is known for her research identifying genes required for early development of the zebrafish and genes that predispose adult fish to cancer, as well as for her work promoting equality of opportunity for [women scientists in academia](#). Recently she has addressed the under-representation of women as founders and board members of biotech start-ups. She is a member of the National Academy of Sciences, the Institute of Medicine of the National Academy, and the American Academy of Arts and Sciences.



Raychelle Burks is a professor of analytical chemistry at American University in Washington, D.C. Her research focuses on developing low-cost colorimetric sensors for detecting chemicals of forensic interest, including explosives and regulated drugs. As a science communicator, Burks has appeared on the Science Channel's Outrageous Acts of Science, the American Chemical Society's Reactions videos, Royal Society of Chemistry podcasts, and at genre conventions such as DragonCon and GeekGirlCon. Burks was awarded the 2020 American Chemical Society Grady-Stack award for excellence in public engagement.



Jane Willenbring is a geomorphologist and associate professor of geological sciences at Stanford University, and is the director of the Stanford Cosmogenic Isotope Laboratory. Willenbring's research examines the evolution of the Earth's surface, especially how landscapes are affected by tectonics, climate change, and life. She is a Geological Society of America Fellow, the recipient of the Antarctica Service Medal, the National Science Foundation Career Award, and in 2020 was named one of Stanford's future Gabilan Faculty Fellows.



MEET THE SCIENTISTS



PAULA JOHNSON is a **cardiologist** and the first Black woman to serve as President of Wellesley College. She founded the Mary Horrigan Connors Center for Women’s Health & Gender Biology and served as its inaugural executive director. Her research and work intersects education, health care, and public health, and she has won numerous awards for her contributions to women’s health.

ROBERT BROWN is a **chemical engineer** and President of Boston University who also served as provost and professor at the Massachusetts Institute of Technology. He has published more than 250 papers and was named one of the top 100 Chemical Engineers of the Modern Era by the American Institute of Chemical Engineers.

MARCIA McNUTT is a **geophysicist** and the 22nd president of the National Academy of Sciences. Her research has contributed to our understanding of oceanic tectonic plates.

MAHZARIN BANAJI is a Harvard **psychologist** whose primary focus is on human thinking and feeling in social contexts. Along with Dr. Anthony Greenwald and Dr. Brian Nosek, she founded Project Implicit, an organization that focuses on research and education on implicit cognition. Most recently she was inducted into the National Academy of Science and was elected to the American Philosophical Society. In 2013, she published *Blindspot: Hidden Biases of Good People* with Dr. Greenwald.

LOTTE BAILYN is the T Wilson Professor of **Management**, Emerita at the MIT Sloan School of Management and former Chair of the MIT faculty. In 1993 she wrote the book *Breaking the Mold: Men, Women, and Time in the New Corporate World*, arguing that separation of work and family is untenable.

SYLVIA CEYER is a **chemist** who studies surface reactions on the nanoparticle level, observed under ultra high vacuum conditions. She discovered a reaction that is essential for semiconductor-device etching.

PENNY CHISHOLM is a **biological oceanographer** and professor of civil and environmental engineering at the Massachusetts Institute of Technology. She studies the microorganism *Prochlorococcus*, a tiny marine bacterium vital to the production of earth's oxygen. She is a recipient of the National Medal of Science.

LORNA GIBSON is a **materials scientist** and engineer, and a professor at MIT. She studies the mechanical behavior of materials and has written several books about cellular materials. In 2015, Gibson was named a MacVicar Faculty Fellow, MIT's top award for undergraduate teaching.

RUTH LEHMANN is Director of the Whitehead Institute. Her research focuses on **germ cell development** and the formation and development of embryos.

TERRY ORR-WEAVER is a **molecular biologist** whose research on cell division led to the identification of proteins implicated in human cancers and birth defects.

MARY-LOU PARDUE is a **geneticist** whose research on chromosomes allowed scientists to better understand the evolution of eukaryotes, a branch of the tree of life that includes humans.

MOLLY POTTER is a **psychologist** whose research into human cognition revealed the structures in the brain that enable learning.

PAOLA RIZZOLI is an **oceanographer** who studies climate and ocean circulation using mathematical models. She is consulting with the city of Venice to design a system to protect it from extreme floods.

LEIGH ROYDEN is a **geologist** who studies plate tectonics and continental collision using geophysical modeling.

JOANNE STUBBE is a **chemist** who was awarded the National Medal of Science for her work revealing the mechanisms of enzymes that enable DNA replication and repair.

SANGEETA BHATIA is a **biomedical** researcher, professor, and biotech entrepreneur who is trained as both a physician and an engineer. An advocate for diversity in science and engineering, she was awarded a Heinz Medal for groundbreaking inventions and advocacy for women in STEM.

KATHRYN CLANCY is a **biological anthropologist** whose research intersects feminism and biology. In 2018 she provided testimony at a hearing of the Congressional Subcommittee on Research and Technology and co-authored a National Academies report on sexual harassment of women in STEM.

ADAM LEWIS is a Calgary-based **geologist** whose research has focused on the growth of the East Antarctic Ice Sheet and its influence on global climate evolution. He was formerly an assistant professor in the Department of Geosciences at North Dakota State University.

CORINNE MOSS-RACUSIN is a **social psychologist** and associate professor at Skidmore College whose research is focused on diversity and gender roles, gender discrimination, and implicit social cognition. Her research on gender bias includes an experiment that asked scientists to evaluate identical resumes of "Jennifer" or "John."



DISCUSSION QUESTIONS

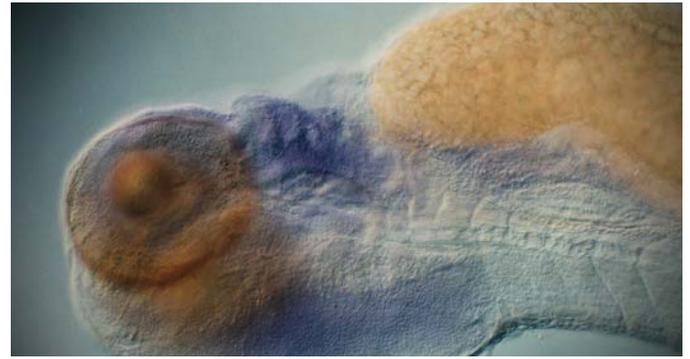
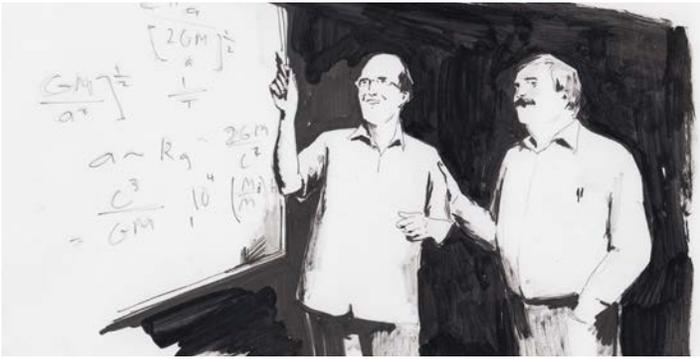


A goal of Picture a Scientist is to act as a catalyst for necessary reflection, discussion, and change. Here are a few starting points for conversations; not all questions will be applicable for all viewers, and not all questions will be for group discussion, but we invite you to use and modify them for your own screenings. Given the personal nature of some of these questions, we suggest you enter into discussions with sensitivity, openness, and an understanding that some people directly impacted by these issues may not want to respond in a group setting.

PRE-SCREENING

Before the film, viewers can reflect on these questions:

1. How do you picture a typical scientist?
2. What issues do you expect to see in a film about women and diversity in science?
3. Why are you watching the film? What are your goals?
4. Do you have any current events in mind when going in to watch this film?
5. Why is diversity in science important to you?



POST-SCREENING

These questions can guide general discussions after viewing the film:

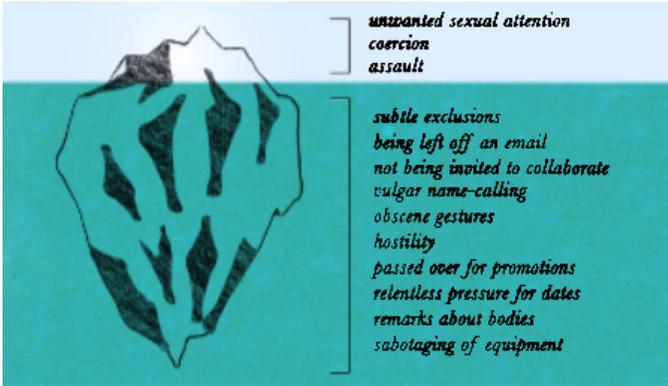
1. How do you picture a typical scientist now? Has it changed from before the film?
2. How did you feel after watching the film?
3. Did anything surprise you? Why or Why not?
4. What new ideas do you have about ways to make science more equitable for everyone?
5. Has the film changed your perspective at all on diversity in science?
6. How can institutions companies change mentorship or management structures to better protect people from potential harassment and inequity?
7. How do some of the experiences shared in the film compare to your own?
8. What would you do if a person junior to you came to you with experiences of sexual harassment?
9. How can the science community accommodate identities who don't have clearly visible markers of marginalization (e.g., sexual orientation, low-income, disability, mental health, etc.)? How might the struggles of folks with these backgrounds be different from those portrayed in the film?

DISCUSSION QUESTIONS

by section

I. the tip of the iceberg

1. Dr. Jane Willenbring describes being triggered when her 3-year-old daughter visited her lab. Could you identify with the way she felt? Have you had a similar experience?
2. Why do you think Dr. Nancy Hopkins reacted the way she did to her encounter with Francis Crick?
3. Dr. Willenbring described her decision to wait to report what happened to her in Antarctica. Why do you think she made that choice? Do you think you would have made the same choice?
4. What would be other reasons women may choose to wait to report, or not report such incidents? How do you think these concerns may vary between academia and various science industries?
5. In Dr. Willenbring's segment, she describes how, among other behaviors, her supervisor (David Marchant) made it to the top of the hill first and pushed her down. Have you ever been hazed? Is there a difference between hazing and bullying?
6. Should the focus of a resulting complaint be on the intent of the perpetrator or the impact on the complainant?
7. The National Academies of Science report describes sexual harassment as an iceberg, with the vast majority consisting of subtle slights and microaggressions. Have you ever experienced or witnessed activities such as subtle exclusion or not being invited to meetings where you are an expert? How did it make you feel? What did you do to combat the feeling?



II. the underneath

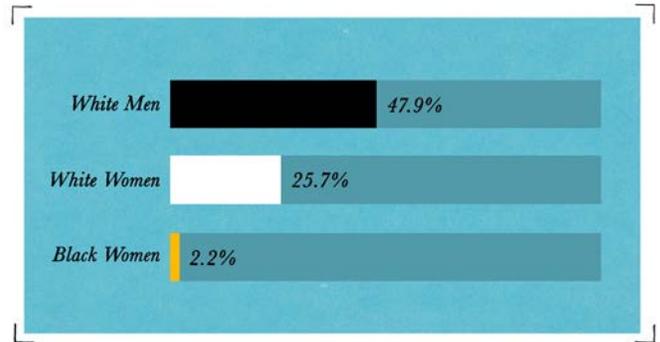
1. Dr. Raychelle Burks discusses the time she has to spend carefully crafting responses to people, above and beyond her lab and research responsibilities.
2. What's the longest amount of time you've spent writing an e-mail to prevent being stereotyped or viewed in a particular way? What label were you trying to avoid? Did it work? Did you successfully avoid that label?
3. Dr. Burks talks about the pressure of conforming her reactions to inappropriate behavior so she isn't dismissed and cast into "the angry Black woman trope." What are some of the ways that you have felt pressure to conform? How did it impact you and your work? How might that pressure differ for white people vs. for people of color?
4. Dr. Burks describes some of the slights she has endured in her career, like being mistaken for a janitor, being ignored in meetings, or being told to straighten her hair for a more professional appearance. Have you experienced or witnessed similar behavior? How did it impact your work?
5. Dr. Burks discusses her childhood scientist heroes coming from sci-fi. Did you have any science heroes growing up? Who were they?





III. data driven

1. Dr. Willenbring talks about considering leaving her scientific field as a result of her experiences. Have you ever considered quitting as a result of someone questioning your competence to be in your field, or as a result of harassment and other negative experiences?
2. Dr. Burks said: “You get used to being underestimated. You get used to being treated a bit shabbily... You get used to being invisible in the sciences.” Have you ever felt like you don’t belong or fit in? How did Dr. Burks’ experience inform or change your idea of what it is like for women of color to be invisible in the sciences? Do you think white women experience this differently? Why or why not? Who else might feel invisible in the sciences?
3. Dr. Burks describes science panels as not being very inclusive, and that they tend to be composed of white and male scientists. What have been some of your observations and experiences with panels at professional events or conferences?
4. Dr. Hopkins talks about her early efforts to involve other women in her fight for equity at MIT. She said: “I expected to fight alone. I didn’t expect anyone to fight with me.” Have you ever felt alone in your struggles? How can we find others with whom to share our experiences or feel less alone? What should we do if we are “the only one” in our academic circle? How can we become allies to support people from marginalized identities?



Ph.D.s in STEM Fields Awarded to U.S. Citizens, 2016

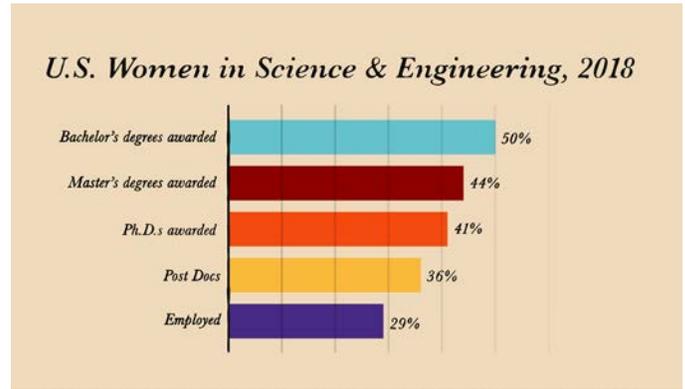
5. Dr. Hopkins describes how no women in the MIT group of female scientists she convened had ever taken family leave and gotten tenure, because of the stigma attached to family leave. Have you ever felt afraid to take time off or to take advantage of benefits like maternity or paternity leave? If you took advantage of these benefits, did you feel this lowered the expectations on your productivity and potential success?

6. Dr. Hopkins worked to bring data to light to prove the gender inequity she saw and experienced at MIT, starting with measuring lab space. She then organized a group to demand more data. Why do you think Dr. Hopkins needed to obtain data to prove the inequality she saw and experienced? How do we get the

data necessary to show inequality? What type of data would be most effective? What mechanisms exist to then share the data in order to take action? What role can professional societies or other groups play in gathering and publishing data on these matters?

7. Who exactly needs to see the data to be convinced that sexual harassment is a pervasive problem in the sciences? People in power, or those directly impacted?





IV. the nature of the beast

1. Dr. Sangeeta Bhatia described witnessing the “leaky pipeline.” What factors do you think contribute to the leaky pipeline? Is this a helpful or harmful analogy, as it uses passive language to discuss a problem that can be solved through action?
2. Dr. Corinne Moss-Racusin described her and colleagues’ [study](#) looking at applicants who were identical except for their gender. Were you surprised to see the results? How did it strike you that the same implicit bias against women is observed in all faculty, regardless of their gender?
3. Dr. Mahzarin Banaji describes the [Implicit Bias Test \(IAT\)](#) and demonstrates it with a group. Had you heard of the IAT before and if not, were you surprised by the results Mahzarin described? Why or Why not? Have you taken the test yourself?
4. Dr. Banaji and Dr. Hopkins discuss the need for data to show people who do not believe they are biased or who have never experienced bias that it does exist. Where is the line between someone not experiencing bias and someone turning a blind eye to it amidst a sea of data? Do you think documented, reliable data would change people’s minds?





V. the eyes to see

1. Dr. Burks discusses her science communication work and the importance of representation in science. Why is it important for young people to see role models representative of their identities? What kind of impact do you think representation of race and gender bears for young girls entering the sciences? Why is representation particularly important for women of color in science?
2. Dr. Burks talks about emboldening herself—instead of fitting into the mold of what a scientist has historically looked like, she decided to have fun and become more authentically herself. Why do you think this was important for her? Have you ever made that choice? If so, why?
3. How did Dr. Burks' story shape or validate your understanding of the experience of people—and especially women—of color in science? Did her experiences surprise you? Do you think her experience translates in your field or your personal path?
4. Dr. Willenbring describes to Dr. Adam Lewis how women may experience various scenarios with men at conferences and how that can lead to people believing women are undeserving of their positions. What are some things individuals can do to address these situations? What can conferences and organizations do to help?
5. Dr. Willenbring has said she views Dr. Lewis as a friend and ally. Do you view him as an ally? Why or why not? Have you ever witnessed something and not realized the seriousness of it until much later? What makes someone a good ally?
6. Dr. Mahzarin Banaji asks “How many great discoveries have been lost because we didn't have the eyes to see?” What does that statement bring to mind for you? How does it make you feel?



VI. the scouts before the troops

1. The MIT report exposed inequities such as: pay disparity, lab space, childcare. How have such factors played into your career path?
2. Why do you think the MIT study took so long to complete to show all the evidence in the report?
3. Were you surprised to hear that the MIT president wrote a letter of endorsement of the report showing gender discrimination? Why or why not?
4. Dr. Robert Brown discussed the challenge of MIT considering itself a meritocracy in dealing with gender bias. Is the idea of “meritocracy” incompatible with the idea of gender and racial equity?
5. Dr. Sangeeta Bhatia said that in the wake of the report, people are now monitoring her pay and looking out for her to ensure continued equity. Why do you think such ongoing vigilance is necessary? How can we pay it forward for the next generation?
6. Dr. Raychelle Burks talked about “code-switching” –changing your speech and mannerisms depending on the cultural and social context, such as between workplace and private lives, for example. Have you ever felt internal or external pressure to code-switch based on concerns over perceived stereotypes? What are some of the ways you have had to code-switch in your own life?



7. Dr. Raychelle Burks said: “It’s about doing. The correction requires action.” What actions do you think still need to be taken to make science more equitable? Is it possible to be inclusive in the framework we are familiar with or do we need to rethink higher education or corporate structures when our goal is to center social justice? Whose actions (faculty, administrators, institutions, professional societies, etc.) you think would bring more long-lasting change in science?

8. Dr. Jane Willenbring said: “One of my goals in mentoring was to be someone I needed when I was younger.” What are your goals in mentoring?

9. What does it mean to you to “move away from a culture of compliance and toward a culture of change”, to quote Dr. Kate Clancy testifying to the U.S. House of Representatives Science, Space and Technology Committee?

10. A major pioneer in the movement for gender equity in science (Dr. Nancy Hopkins) said that she wasn’t sure she would go through it all again because of the amount of time and effort that her (hugely successful) fight took away from her science. How does that make you feel?



WAYS TO TAKE ACTION

Picture a Scientist is an invitation not just to examine our own biases (in our organizations, in the systems that govern our lives, in ourselves), but to be vigilant in recognizing and dismantling those biases. Here are some ways we can begin the work together to enact meaningful change.



Share your experiences.

Share your experiences on the Picture a Scientist Sharing Wall, which will be coming soon to Instagram. As with the film, we are interested in stories about #AlliesinScience and #WomeninScience, those who identify as women of color and white women. The goal of the wall is to expand the conversations from the film Picture a Scientist, so that minorities in science can see they are not alone and share their stories to inform and advance efforts to change the culture of science.

Get involved.

You can volunteer your time and donate to such organizations working toward a more equitable society. Many great organizations focus on equity, justice, and inclusion in STEMM, such as:

- 500 Women Scientists
- SACNAS
- 500 Queer Scientists
- Scientista
- Association for Women in Science
- Society of Women Engineers
- The SERCH Foundation

Participate in a study.

You are invited to take part in a brief survey assessing your impressions and reactions to *Picture a Scientist*. In particular, the goal of this survey is to assess your reactions to the film, as well as your plans for the future and specific actions inspired by the film. The results from this survey will help us identify the positive impact of this film and explore how reactions to films may influence beneficial changes in behavior.

This research is being conducted by two psychology professors, Dr. Eva Pietri (an Assistant Professor at Indiana University-Purdue University Indianapolis) and Dr. Corinne Moss-Racusin (Associate Professor at Skidmore College), and Arispa Weigold (a student working with Dr. Pietri).

If you choose to participate, your answers will be confidential and only the researchers will have access to your data.

We ask that you please complete the survey at your soonest convenience after watching *Picture a Scientist*, and we will then have a follow-up survey we would love for you to complete two months from now.

We would very much appreciate your help with this survey! It should only take 10 minutes to complete, and you can access it [here](#).



Request a training.

Transforming a culture of deep-seated bias and harassment requires an overhaul from the ground up—that means disrupting systemic norms and challenging learned behavior at home, in the community, at school, and in the workplace. Myriad programs offer training for bystander intervention, harassment prevention, conflict de-escalation, and resilience in the workplace. [Hollaback](#), for example, offers training that gives people the confidence to take action when they witness harassment.

Here are other resources:

- **UnboundEd.** This resource empowers educators and provides various kinds of training, analysis, and support for implementing equitable and anti-racist policies and practices in the school and for families at home.
- **Lifting Limits.** Implicit gender bias starts early, and this UK-based program promotes early intervention and gender equality in education. They provide guides for families, activities for children, and gender bias training for educators.
- **Step UP! Bystander Intervention Program.** Developed by the University of Arizona in partnership with the NCAA, Step UP! is a bystander intervention training program that first emphasizes an awareness of harmful prosocial behavior and then provides skills to step up against harassment. This is used in the university setting but applicable to the workplace.
- **Video Interventions for Diversity in STEM (VIDS).** Developed by social psychologists, working with professional filmmakers and funded by the Alfred P. Sloan Foundation, VIDS consists of two sets of short videos that expose participants to empirical results from published gender bias research. “Results suggest that this easily-disseminated intervention can ameliorate pernicious STEM gender biases.”
- **Project Implicit.** Getting to know our own implicit biases is perhaps the first step we can all take towards dismantling discriminatory systems. Take the implicit bias test yourself at [Project Implicit](#).

Be an ally.

Amplify voices of women and minority scientists in your organization.

Work to hire and promote women across your institution/company.

Work to change processes in your organization to make them less prone to bias and more accountable for sexual harassment and discrimination.

Fight to make service (mentorship, outreach, commitment to inclusive science) – not just teaching, research, or productivity – play a larger role in tenure and promotion decisions.

Mentor a young person in science and show them the power of diversity (You can add your credentials to the [Request a Woman in STEM platform](#).)

Hold a workshop related to implicit bias.

Host a learning section about how tenure or promotion decisions are made in your institution/company.

Take family leave and work within your department/work unit to destigmatize childcare and family leave.

Work to create new internal mechanisms for reporting and addressing harassment.

Analyze and address how effective those mechanisms are.

Lead by example.

Educate yourself. Our resource guide below has a number of ways to learn more about the topics explored in the film.



RESOURCE GUIDE

These statistics, reports, studies, and online resources can help you further explore gender bias and racism in the sciences.

I. TIMELINE OF CHANGE

Recent progress for the advancement of women in STEM is an important reminder that real change is possible. Here's a snapshot of change we see happening.

 = MIT points from the film

 = BU points from the film

 = All other points

1999

Release of landmark Study on the Status of Women Faculty in Science at MIT (United States)

2000

2001

MIT report leads 9 research universities to collaborate to address issues of gender equality. (U.S.)

2002

2003

2004

Number of tenured women faculty at MIT doubles. Construction begins on a daycare center on campus. (U.S.)

...

2012

Girls Who Code: group launches to close the gender gap in tech (U.S.)

2013

2014

Three Circles of Alemat launches: online mentoring program for Arab women scientists (Jordan)

Laboratoria: trains women from underserved backgrounds to be software developers (Peru, Chile, Mexico, Colombia, Brazil)

TIMELINE OF CHANGE (CONTD)

2015

Minas Programam initiative created to challenge gender and race stereotypes in STEM (Brazil)

First Nobel Prize in the sciences awarded to a woman of color (China)

Wikipedia: grassroots efforts launched to expand the ranks of women scientists (WORLDWIDE)

Black Women in Science group launched (South Africa)

2016

Jane Willenbring files Title IX complaint against former Boston University thesis advisor David Marchant. (U.S.)

B.U. opens an investigation into allegations of sexual misconduct against David Marchant. (U.S.)



2017

DC: Women on the Walls campaign launches. (U.S.)

Afghan girls robotics team takes home a top prize at Europe's largest robotics festival. (Afghanistan)

Boston University faculty committee investigating allegations against David Marchant recommends he be placed on leave for 3 years and then allowed to return. (U.S.)

2018

Request a Woman Scientist: new database of 8,000 women scientists (U.S.)

Draw-a-scientist: rise in female representation (U.S.)

Girls Scouts announce 30 new STEM badges. (U.S.)

Third woman recipient of Nobel Prize in Physics (Canada)

NASEM releases report on sexual harassment in STEM fields (U.S.)

United States Board on Geographic Names renames Marchant Glacier in Antarctica to Matataua Glacier. (U.S.)

 = BU points from the film

 = All other points

TIMELINE OF CHANGE (CONTD)

2019

National Institutes of Health: director calls for end to all-male panels (U.S.)

House: passes Building Blocks of STEM act. (U.S.)

New brain-scan: study shows no gender difference in math (U.S.)

Dartmouth: settles Title IX sexual misconduct suit for \$17m (U.S.)

National Academy of Sciences: votes to eject sexual harassers (U.S.)

NASA: First all-female space walk (U.S.)

New NSF rules: requires awardees to report Title IX findings (U.S.)

Cognitive neuroscientist Gina Rippon's debunks the myth of the gendered brain in her new book (U.S.)

Network of African Women Environmentalists (NAWE) launched (Kenya)



University President Brown overrules B.U. faculty panel's recommendation and fires David Marchant. (U.S.)

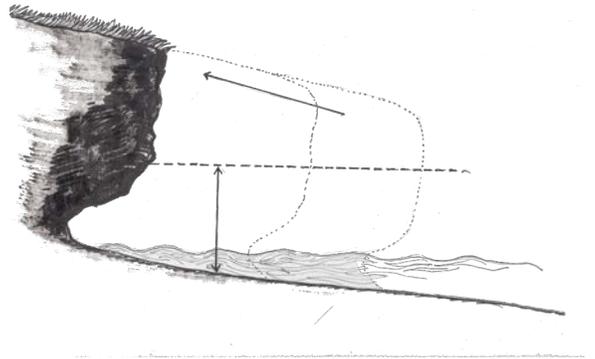
2020

SuperScientists campaign inspires young women to see themselves as working scientists (South Africa)

Eindhoven University of Technology introduces Irene Curie fellowship to fill senior STEM positions (Netherlands)

Nearly all-female team develops India's first COVID-19 diagnostic test kit in six weeks (India)

FAA fields first all women ground crew for commercial launch (U.S.)



= BU points from the film

= All other points



II. KEY RESOURCES FROM THE FILM

IAT - Project Implicit

Founded in 1988 by scientists Dr. Anthony Greenwald, Dr. Mahzarin Banaji, and Dr. Brian Nosek, Project Implicit is a non-profit organization that investigates implicit social cognition and provides tools for educating the public about implicit bias. It is also home to the Implicit Association Test (IAT), an online test anyone can take to measure one's implicit biases.

The NAS report, [Sexual Harassment of Women](#)

"This is a superb report describing the persistence and types of gender and sexual harassment of women in STEM and a call for change to the culture." - Dr. Nancy Hopkins

The MIT report, [A Study on the Status of Women Faculty In Science at MIT](#)

"A data-driven study of the experiences of women faculty in science at MIT as of the 1990s that was endorsed by the Dean of Science and the President of MIT and led to many changes for women in STEM at MIT and nationally." - Dr. Nancy Hopkins

Title IX

Title IX is a federal civil rights law that states: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." Anyone can file a Title IX complaint with the Department of Education's Office for Civil Rights.

III. SCIENTIFIC STUDIES

Implicit Stereotyping in Person Judgment (Banaji et al., 1993)

Dr. Mahazrin Banaji's studies on implicit gender stereotyping, conducted with students Curtis Hardin and Alex Rothman. This study was the first to use the term "implicit stereotyping."

Implicit social cognition: attitudes, self-esteem, and stereotypes (Greenwald et al., 1995)

Dr. Banaji and Dr. Greenwald's 1995 study which supported the view that social behavior often operates in an implicit or unconscious fashion.

Nepotism and sexism in peer-review (Wenneras and Wold, 1997)

Dr. Hopkins: "A bombshell publication that got the attention of the scientific establishment about invisible discrimination against women in STEM fields."

Does Gender Matter? (Barres, 2006)

Dr. Hopkins: "A brilliant response by a transgender scientist to a speech by then Harvard President Larry Summers hypothesizing that the dearth of women at the high end in STEM might be due to genetics."

Ambient belonging: how stereotypical cues impact gender participation in computer science (Cheryan et. al, 2009)

The studies within this article demonstrate that the gender difference in interest in computer science is influenced by exposure to environments associated with computer scientists.



SCIENTIFIC STUDIES (contd)

Science faculty's subtle gender biases favor male students (Moss-Racusin et al., 2012)

Dr. Hopkins: "A classic demonstration of how scientists are biased in their evaluation of male vs female scientists and how this affects the reward system."

Quality of evidence revealing subtle gender biases in science is in the eye of the beholder (Handley et al., 2015)

An examination into the difference between the way genders evaluate the quality of research unveiling bias against women in STEM fields: men consider the research less meritorious than women do.

Survey of academic field experiences (SAFE): Trainees report harassment and assault (Clancy et al., 2014)

Dr. Kate Clancy leads this study, which suggests that policies enforcing inclusivity and safety could greatly improve the field experiences of many researchers, especially early in their careers.

Double jeopardy in astronomy and planetary science: Women of color face greater risks of gendered and racial harassment (Clancy et. al, 2017)

A survey of more than 400 scientists revealed that women of color experienced the highest rates of negative workplace experiences, including harassment and assault.

Gender in Science, Technology, Engineering, and Mathematics: Issues, Causes, Solutions (Charlesworth and Banaji, 2019)

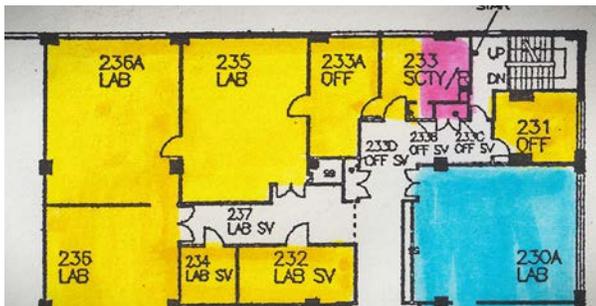
Dr. Hopkins: "How can one reduce gender bias? Research and discussion from the lab of Mahzarin Banaji, a leader in this field."

Sexual harassment reported by undergraduate female physicists (Ayccock et al., 2019)

A survey of undergraduate women in physics revealed that approximately three quarters of the respondents experienced at least one type of sexual harassment. The findings have implications for the retention of women in physics and point to the need to reduce harassment in the STEM environment.

Historical comparison of gender inequality in scientific careers across countries and disciplines (Huang et al., 2020)

An analysis of academic publishing careers covering 83 countries and 13 disciplines finds that the academic system is losing women at a higher rate at every stage of their careers, suggesting that focus on retention and advancement should span the entirety of one's career, not just the early part of a junior scientist's experience.



IV. OTHER RECOMMENDED ONLINE RESOURCES

National Girls Collaborative Project

A collaborative project that brings together organizations in the U.S. to encourage girls to pursue careers in STEM,

IF/THEN She Can

A national initiative in the U.S. to inspire young girls to pursue careers in STEM by highlighting high profile women in STEM as role models and shifting how women in STEM are portrayed and perceived in the media.

Women in STEM podcasts to check out

A list of 5 podcasts about women in science.

“NIH’s Scientific Approach to Inclusive Excellence” (talk by Hannah Valentine, National Institutes of Health)

“An outstanding talk about the issues of gender and race bias in STEM and how the NIH is addressing them.” – Dr Nancy Hopkins

The urgency of intersectionality

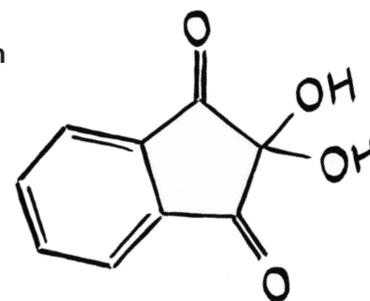
TED Talk by Kimberlé Crenshaw, who coined the term intersectionality, explores how based on their identities one person might faces multiple forms of exclusion.

Why So Slow? (Valian, 1999)

“A superb summary of research by psychologists on the unconscious undervaluation of women and their accomplishments by both men and women.” – Dr Nancy Hopkins

The Double Bind: The Price of Being a Minority Woman in Science

A groundbreaking report published in 1976 that articulated the additional disadvantages faced by women of racial and ethnic minorities in science.



DIRECTOR FAQ

*We speak with directors Ian Cheney and Sharon Shattuck to find out more about the inspiration behind and trajectory of *Picture a Scientist*, and the impact they hope it has in shaping a more welcoming and inclusive STEM environment.*



Q: What inspired you to make this film?

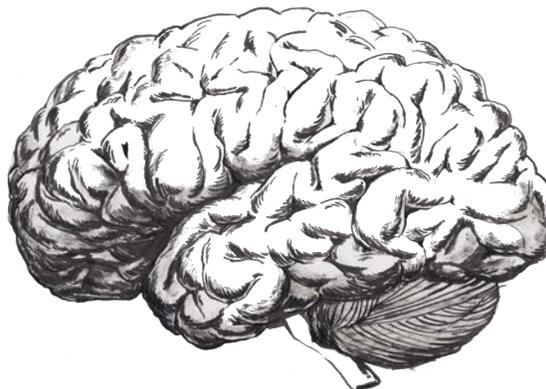
Sharon and Ian: Our journey began with the MIT story and biologist Nancy Hopkins, who we were connected to via the film's Executive Producer, Amy Brand.

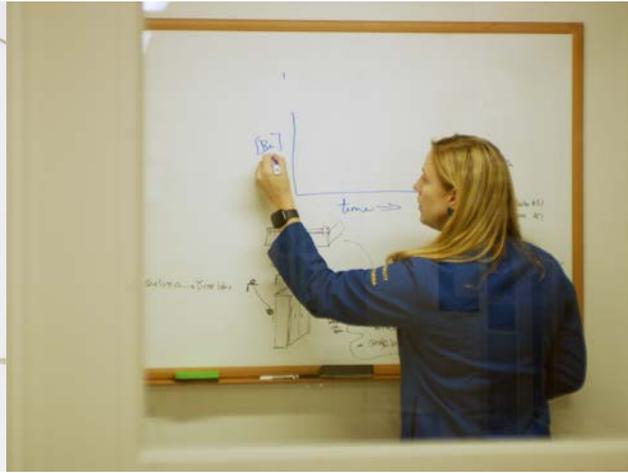
While immersed in exploring the story of the remarkable success of the 1999 MIT report, we also realized that the problems that women in science face are far from over. The #MeToo movement made that clear across all areas, but with our science backgrounds and interests, we really wanted to shine a light on this issue in science specifically. The data show that today only 33% of working scientists are women, so we began talking with many scientists to further understand the problem.

Once we realized the vast extent of the challenge, we saw an opportunity to broaden the conversation toward change by putting the stories of women scientists front and center, and *Picture a Scientist* was born.

Q: What was your approach for building out the narrative?

Sharon and Ian We wanted the film to showcase these incredible women scientists and their research, while, in parallel, taking a deep dive into the science of gender bias. The personal stories of our scientists might on their own be seen as anecdotal, individual instances of bad luck – but by including pivotal research studies on gender bias, we're backing up and underlining their stories with data, and showing how systemic and long-standing the problem of gender bias is.





Q: How did you come to collaborate on this together?

Sharon: Ian and I have collaborated on films for over 10 years. We both have backgrounds in the sciences. (I worked as a conservation botanist with the Smithsonian Tropical Research Institute and the Field Museum, and Ian got a master's degree at the Yale School of Forestry & Environmental Studies.)

One of our primary goals as collaborators is to make visually stunning, story-driven films about science. When we first started working together, I had just switched to filmmaking from botany and was self-training as an animator, so I ended up doing the animations for several of Ian's films. After I directed my own feature film and a series of short science films for the New York Times, we began to co-direct. Ian was actually approached first about directing this film, and he brought me in as co-director.

I think the film has really benefited from having a mixed-gender directing team. Several of the more sensitive interviews I did alone, and I sometimes wonder if women would have talked so openly about the harassment they've experienced with a man, even a man as sympathetic as Ian.

That said, Ian also is one of the most compassionate people I know, and he's able to establish rapport and trust with his subjects in a way that still blows me away. I also wonder whether Ian would have had a different experience interviewing the men in the film solo. We weren't able to try that during the making of this film, but it's definitely an experiment I want to do in the future!

The other wonderful thing here about having a co-collaborator is having a partner to decide (and debate!) which stories to highlight and how to build the narrative. Like in all things, having a diversity of perspectives in the edit room enriches the creative experience.

Q: How did you identify the lead female scientists to feature?

Sharon and Ian: We knew we wanted to feature the idea of the “sexual harassment iceberg” – an idea prominently featured in the [NAS report on sexual harassment in the sciences](#). Basically, the idea is that blatant harassment like sexual coercion, come-ons, and assault are only about 10% of the harassment that women face in the workplace; the other 90% are more subtle slights like insults and exclusion. But long-term, those subtler slights can be just as damaging to a woman’s career. We thought the best way to highlight this idea was by structuring the film around three stories of women at different points in their career, facing different types of harassment.

The MIT story is one of a senior faculty member, Dr. Nancy Hopkins, working to create change within the system with very positive results. But we also wanted to show what happens when women are essentially left to cope with harassment on their own. That was the case for Dr. Jane Willenbring, who waited to file her Title IX lawsuit until she had tenure and was relatively safe from repercussions. Dr. Raychelle Burks’ story viscerally shows how thousands of little slights can affect a scientist’s psyche – but despite countless setbacks and demands on her time that her male and white peers have not experienced, she has managed to forge her own path and is now not only an accomplished chemist, but also a pop-culture chemistry star, inspiring younger scientists everywhere.

Q: The film deals with some difficult themes of harassment. How did you approach this challenge?

Sharon: Harassment is a sensitive topic, but it’s also one that I believe pretty much EVERY woman has faced in some form in their careers, whether they admit it or not. As a filmmaker who’s also worked in television, I’m unfortunately very familiar with that feeling of being 99.9% sure you’re being discriminated against because of your gender, but knowing that you can’t say anything because no one in power would believe you. That fear of being labeled a “difficult woman” that Dr. Nancy Hopkins vocalized so well in the film is, unfortunately, still very real. So, when I talked with our scientists about the harassment they experienced, I felt both sympathy and raw indignation that women have had to deal with these same issues over and over. But I also found a lot of solace in the data on gender bias – it made me feel less alone to know that so many other women, even brilliant scientists at the pinnacle of their careers, have faced these issues.

Ultimately, we didn’t want to shy away from the difficulties our scientists faced, but their stories are also hopeful: These women successfully navigated less-than-ideal situations to forge careers that worked for them. Their experiences will undoubtedly serve as roadmaps to others – by being who they are and leading by example, they’re making science more open and accessible to a new generation of women.

Q: How do you think scientists are changing in their overall approach to politics and activism?

Ian: For a long time, in the popular imagination a brilliant scientist was thought to be a lone man who dedicated himself almost maniacally to science. Under this paradigm, it was possible to be a good scientist and also a bad human: Society will forgive your eccentricities, and perhaps even your transgressions, because of your contribution to human knowledge. Under this paradigm, the best science is thought to emerge from the most concentrated effort on science, and science alone. Under this paradigm, there is pressure to put aside concerns about the culture of science – how people are treated, whether resources are shared equitably, the

diversity and inclusiveness of the community – because it might take away from time in the lab. Today this paradigm is shifting. Many scientists we spoke to are not only keenly aware of the importance of improving the culture of science, but they’re also aware that it’s likely better for science as a whole. Perhaps the definition of a “good scientist” can evolve to include someone who not only excels in the lab or in the field, but who also actively advocates for their peers, contributes to their community, and mentors the next generation of scientists in an inclusive and supportive way. Advocacy, in this light, is not a liability for a scientist, it’s an asset: It builds a better culture of science. And here I’m hopeful that men in particular will step up to play a larger role. It’s time.

Q: Why is diversity in science important?

Sharon and Ian: Science benefits from diversity. Not only is it the right thing to do; it’s the best thing for science. Science benefits from having a diversity of perspectives, from people with different economic and cultural backgrounds contributing. That makes science better for all. If women and minorities are shut out, we could miss out not only on their perspectives but also their actual contributions to important discoveries for society, like during the worldwide effort right now to fight COVID-19. Dr. Nancy Hopkins said it best: “If you believe that passion for science, ability for science, is evenly distributed among the sexes, if you don’t have women, you’ve lost half the best people. Can we really afford to lose those top scientists?”

Q: What actions and conversations do you want to see stem from the film?

Sharon and Ian: So many things! We hope scientists globally will watch the film and then take actions in their own communities. Ultimately, the culture of science must be equitable for all, which means several things:

- 1. Mentorship in the sciences needs reinvention.** The old system is set up so that one advisor has a lot of influence over a young scientist’s career. If something happens and you decide you have to speak out (or even if you don’t speak out, in the case of our anonymous interviewee), your career can be squashed. Furthermore, the women we talked to told us that as they moved up the career ladder and started competing for the same resources, that’s when their male peers really started trying to shut them out. Our hope is that the film can advance this conversation of mentorship and resource-distribution throughout academia.
- 2. Women and minorities shouldn’t have to carry the burden of making science more fair.** The majority group – men – have the lion’s share of the power and resources. Therefore, we hope to see more men becoming advocates, and using their status to demand fair and equal treatment for their women and minority peers.
- 3. Implicit bias needs to be addressed head on.** While this bias will continue, recognizing it as a problem is an important first step in taking interventions to mitigate the impacts. For example, some of the work we featured showed the potential benefits of a gender-blind application process for jobs.



FULL FILM CREDITS



IAN CHENEY

Director and Producer

Ian Cheney is an Emmy-nominated and Peabody Award-winning documentary filmmaker. He has completed nine feature documentaries, including King Corn (2007), The Greening of Southie (2008), The City Dark (2011), The Search for General Tso (2014), Bluespace (2015), The Most Unknown (2018), Picture Character (2019) and Thirteen Ways (2019). His films have premiered at film festivals and theaters worldwide and been released on Netflix, PBS, The Sundance Channel, VICE Media, and other networks. A former Macdowell fellow and Knight Science Journalism fellow at MIT, he lives in Maine.

SHARON SHATTUCK

Director and Producer

Sharon Shattuck is an Emmy-nominated documentary filmmaker and podcast host. Her first feature film From This Day Forward (2015), broadcast on POV (PBS) and was a New York Times Critic's Pick. She's the co-host of the podcast 'Conviction: American Panic' from Gimlet/Spotify, and the co-creator of the Emmy-nominated New York Times Op-Docs paper puppet science series 'Animated Life.' Her work has appeared on PBS, Netflix, National Geographic Channel, The New York Times, Vox, The Atlantic, Vice, ProPublica, Spotify, and Radiolab. She has degrees in forest ecology and journalism.

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Performed by May Erlewine
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